A CULTURAL RESOURCES LITERATURE SEARCH, RECORD REVIEW AND CULTURAL RESOURCES SURVEY OF THE BELLE FOUNTAIN DITCH ENLARGEMENT PROJECT WITHIN POINSETT AND DUNKLIN COUNTIES, MISSOURI

by

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ABSTRACT

On February 4, 1986, Mid-Continental Research Associates contracted with the Memphis District, U.S. Army Corps of Engineers to conduct a cultural resource survey along Belle Fountain Ditch located in Pemiscot and Dunklin Counties, Missouri. The investigations described in this report focus on the survey of the project area on the north and south side of Belle Fountain Ditch. The survey methods, (pedestrain survey with shovel tests were visibility was less than 75%), used for each side are described. No cultural resources were located in the project area during the course of the survey, nor were there any previously recorded archeological sites in the project area. Analysis of the soils and previous work in the project area indicate that this is a low probability area for sites in any pre-drainage landscape. A recommendation for archeological clearance/no further archeological work is made.

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MANAGEMENT SUMMARY

History and Purpose of the Investigation

In February of 1986 the Memphis District of the U.S. Army Corps of Engineers contracted with Mid-Continental Research Associates (MCRA) to conduct a cultural resource survey of Belle Fountain Ditch (BFD), located in Pemiscot and Dunklin Counties, Missouri. Testing of any cultural resources recorded during the course of the project within the survey transect was to be conducted.

The survey of Belle Fountain Ditch was initiated and completed by MCRA personnel on March 6, 1986.

Investigation Methods and Results

Investigation of the project area along Belle Fountain Ditch (BFD) consisted primarily of a pedestrian style survey supplemented with shovel tests in areas possessing less than 75 percent surface visibility. Surface visibility along the south side of BFD generally exceeded 75 percent. Three shovel tests were excavated to a minimum depth of 52 centimeters below the surface. The spacing of the two crew members was 20 meters.

Surface visibility along the north side of BFD ranged from zero to 100 percent. In areas with zero percent surface visibility a total of 21 shovel tests 30 meters apart were excavated. The minimum depth of these shovel tests was 50 centimeters with all soil being passed through 1/4" mesh hardware cloth.

All other areas possessed between 90 to 100 percent surface visibility. In this case investigation was conducted by pedestrian style survey with crew spacing ranging between 20 and 25 meters.

No cultural resources were recorded within the surveyed area during the course of this project. The record review and analysis of the environment resulted in no other site locations and the finding that this is a low probability area for sites, buried or on the surface.

Recommendations

It is recommended that archeological clearance be granted for areas surveyed in connection with this project.

INTRODUCTION

An archeological survey along Belle Fountain Ditch (BFD) (Figure 1) located in Pemiscot and Dunklin Counties, Missouri was conducted by Mid-Continental Research Associates (MCRA) for the U.S. Army Corps of Engineers, Memphis District. MCRA personnel, Michael Sierzchula and Barbara Lisle, began and concluded the fieldwork on March 6, 1986. The purpose of the project was to conduct: 1) a background and literature search of the impact area, 2) an intensive survey, and 3) initial site testing of any prehistoric and historic resources recorded within the project area.

This project was to serve as partial fulfillment of the Memphis District's obligations under the National Environmental Policy Act of 1969 (P.L. 91-190); the National Historic Preservation Act of 1966 (P.L. 89-665); Executive Order 11593; Preservation of Historic and Archeological Data, 1974 (P.L. 93-291); and the Advisory Council on Historic Preservation, "Procedures for the Protection of Historic and Cultural Properties" (36CFR;Part 800) [Federal Register 1976]. These laws and regulations and their specifications in Missouri (Weichman 1978, 1979) and mandate that archeological and historic properties be identified and tested before any project using federal funds are begun, and, if significant properties are identified that a plan be developed to mitigate the project impacts. This report presents the activities carried out in the initial literature search, details the known extent of the data base, reports the results of intensive survey activities, and makes recommendations for efficient identification of all of the significant resources.

This report details the work conducted along (BFD) and the results of these activities.

PROJECT HISTORY

The Purchase Order was issued on 4 February 1986. The fieldwork, delayed due to inclement weather, was conducted on 6 March 1986.

The records review was conducted on 2 April 1986 by Mr. Paul Bauman. Records at the Missouri Archeological Survey and the Office of the Arkansas State Archeologist were consulted to determine the state of knowledge in the region. The Draft Report was submitted to the Corps of Engineers on 14 May 1986 for review.

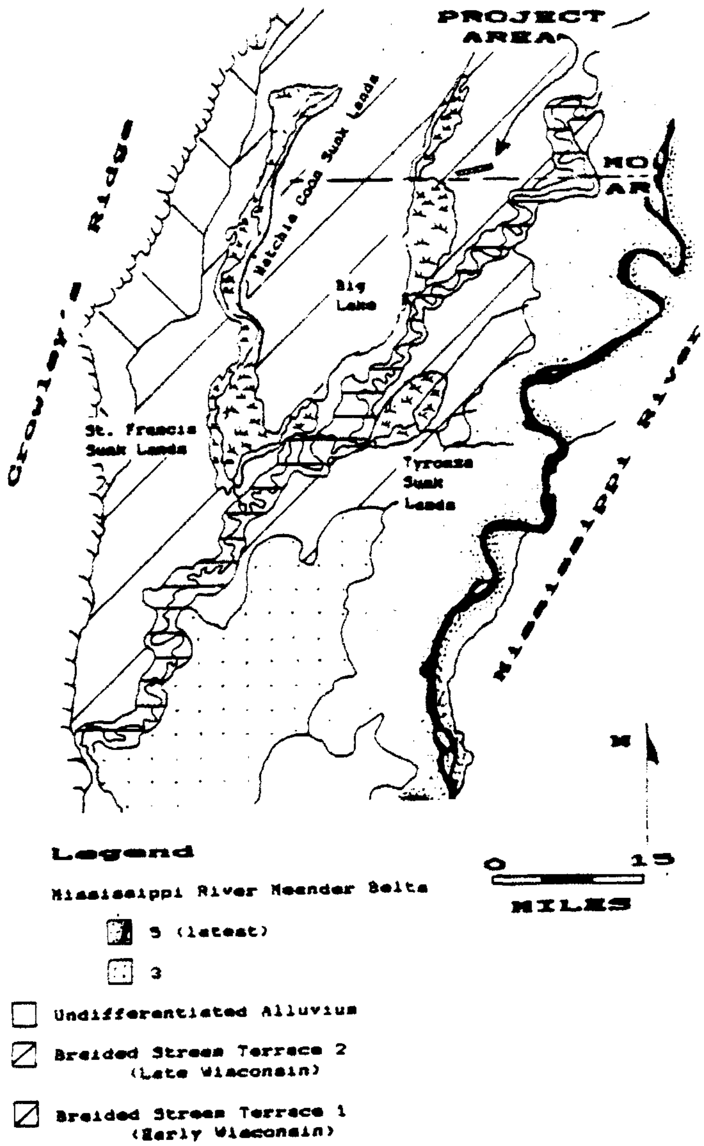

Figure 1. Project area location

PROJECT LOCATION

The BFD project area is situated in extreme southern Pemiscot and Dunklin Counties, Missouri, along and just north of the Missouri/Arkansas state line (Figure 1). Specifically, the area to be surveyed extended from the junction of BFD and the New Connecting Ditch, Lateral 27 northeast, to the junction of BFD and Main Ditch 9. The south side of BFD beginning 300 feet from the top bank and extending to 400 feet (a width of 100' [30m]) was surveyed. In addition to the above the north side of BFD beginning at station 250 + 71 and terminating at station 293 + 63 was to be investigated. The width of the survey transect was 300 feet originating from the top north bank and extending landward (northwest).

ENVIRONMENT

The modern environment of the project area bears little resemblance to its natural state. The swamps have been drained and the natural levees have been precision-land leveled to a three percent grade. Today the perfectly flat fields covered with wheat, beans or milo bear little resemblance to the Southern Floodplain forest which once covered this project area.

The project area is in what is perhaps one of the most highly modified rural landscapes in North America. The major modifications to the landscape include: (1) timbering, which has totally changed the biota, (2) drainage of the swamps, which has made agriculture possible in many parts of the watershed, and (3) land-leveling, which is changing the topography making agriculture more efficient and productive. These changes make it difficult to perceive, much less measure, certain facets of the environment and often obscure the locations of cultural resources. Therefore, the methods of measuring certain past environmental variation must be indirect, because natural topography, flora, and fauna are no longer present in the landscape (Beadles 1976, Figures 5 & 6).

The Relict Braided Surface

The Relict Braided Surface (RBS) was deposited in terminal Pleistocene times by the meltwater from the continental glaciers. Saucier (1974) divides the Braided Stream Surface into two main terraces. The older terrace (T1) is primarily located west of Crowley's Ridge, but a small patch exists east of the ridge in the St. Francis Basin (Figure 3). This terrace is sandier and has greater relief than does the later Terrace 2. Saucier divides Terrace 2 into two sublevels. The project area is within the lower eastern subterrace (Figure 3); however, it appears to be in the more recent backwater swamp clays of the Little River, Big Lake and Pemiscott Bayou which appear to overlay the Braided Surface sands. Recent geomorphic work carried out by MCRA for the Memphis District COE suggest that Big Lake may be a deep aban-

doned clay-filled channel. This work is still in progress and is made difficult due to the masking of features by the aggradation by the Mississippi River, which has reduced relief and obscured older channel scars with clayey backswamp soils. Therefore, the soils in the project area are recent, and site location predictions based on this dimension may not be valid for the past 8,000 to 10,000 years. However, the deep channel incision (24 feet below surface (from 234 to 210 feet above MSL) found at the south end of Big Lake suggests that Big Lake has been in place for a long time and there is virtually no chance for archeological sites to be located there.

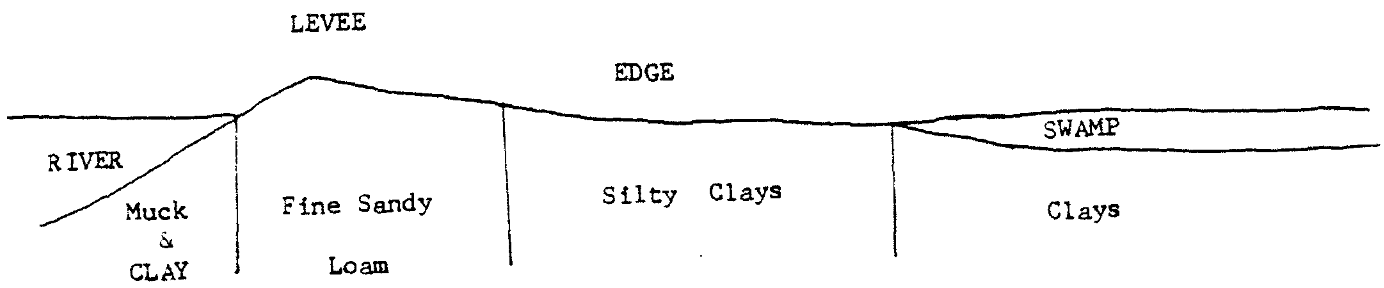

Figure 2. Project Area and the Sunk Lands (after Saucier 1970 and USGS Evadale Quad)

The Old Meander Belt

The Old Meander Belt was incised into the Relict Braided Surface sometime after the latter was deposited. This is located 4 km. to the southeast of the project area and apparently contributed much (some?) of the sediments deposited in the project area through periodic flooding and crevasse breaks in the natural levee. One of these crevasse breaks formed Pemiscot Bayou located 3 km. southeast of the project area. Other crevasse breaks to the north in the headwaters of Little River were apparently the cause of the Mississippi River flowing backwards during the New Madrid earthquake of 1807 to 1809. Present archeological data from this surface suggest that the silting of the Old Meander Belt by the Mississippi River started in the Late Archaic period (ca. 3000 - 500 BC). It appears likely that this happened before the Ohio was captured by the Mississippi River. The wave length of the meanders is about 3.2 km. (ca. 2 miles) with a meander radius of about 800m (ca. 1/2 mile). This compares to the modern wave lengths of about 11km (ca. 7 miles) with 5 km. (ca. 3 mile) meander radii. The shorter wave lengths indicate a much smaller flow than the current flow. The Old Meander Belt's course appears to have been abandoned sometime in the Woodland period (ca. 500 BC- AD 800); however, there have been crevasse breaks in the past century (USGS 1939), and this area was inundated during the 1927 flood. The earliest quadrangle maps for the project area show the mid-19th-century meander line of the Mississippi River well above the modern river banks in Pemiscott Bayou.

SOILS

Soils are the best indicators of past environments in the lower Mississippi Valley. This is due to two characteristics of riverine bottomland: (1) the manner of deposition effectively sorts different-sized particles by elevation, and (2) relative elevation and the water table determine the kinds of biota which can inhabit a particular econiche. These relationships are well established by archeological, geological, and ecological research in the Lower Mississippi Valley (Lewis 1974; Beadles 1976; Harris 1980; Delcourt et al. 1980; King 1981). These relationships are briefly discussed below and related to the basic dimensions used in this research: soils and plant communities.

Figure 2 presents a diagrammatic cross section of a riverine deposit. The river moves in the channel to the left. When it floods, the load capacity of the river is increased. When the river spills over its bank, its velocity is immediately reduced, which lowers its load capacity causing the largest particles it is carrying to be deposited. The repeated flooding will gradually build up a natural levee composed of the largest particles available, sands and silts under the current gradient. This process can be fairly rapid. For example, there are documented instances of as much as 2m of sand being deposited in one flood (Trubowitz 1984). As the levee builds up, a backswamp forms away from the river and smaller particles, clays, are deposited under more slowly flowing slackwater conditions. Under a meandering regime,

the river channel will be cut off, eventually forming an oxbow lake. This will fill with a clay plug in time. Many of these features are still directly observable on soil maps (Ferguson and Grey 1971) and in a few instances on topographic maps; however under the current land-leveling practices these are disappearing rapidly.

SOILS AND BIOTIC COMMUNITIES

The relationship of biota to riverine features in the Lower Mississippi Valley is well known (Lewis 1974; Lafferty 1977; Butler 1978; Morse 1981). Because of the radical changes in the environment in the past century, all of these are reconstructions based on named witness trees in the GLO survey notes. These studies have consistently identified plant communities associated with particular soil types which are diagrammatically presented in Figure 2.

There are two plant communities associated with the levees, the Sweetgum-Elm Cane Ridge Forest and the Cottonwood-Sycamore Natural Levee Forest. These plant communities were the driest environments in the natural landscape and had a high potential for human settlement. They are, in fact, successional stages, with the Cottonwood-Sycamore forest being found along active river channel, while the Cane Ridge Forest is found on the levees of abandoned courses.

There are four aquatic biotic communities: river, lake, marsh and swamp. These low lying areas are unsuitable for human occupation. Several of these are involved in successional sequences; however, since about the Middle Woodland period all were present at any given time prior to drainage. The project area is located in an area which was a swamp and/or previous to that a lake.

Between these two extremes are the river edge communities and the seasonal swamps. In drier times the latter contained areas suitable for occupation. The former is a line-like interface with a steep slope and little substantial flat area.

The correlation between soils and plant communities is not a 1:1 ratio. These deposits are building up and what was at one time a swamp may in a few decades become a dry levee. This process brings about biotic successional changes. However, there is a high correlation between soils and last successional stage plant communities. Because the surface is aggrading, the widest possible extent of habitable dry land, as it was prior to levee construction and drainage, is modeled. This correlation combines the two successional stages of levee biotic communities which are indistinguishable with the synchronic perspective embodied in our data. The edge communities are lumped together, as are the aquatic environments. These communities, all modeled from the last stages of deposition, cannot be distinguished in further detail with our present level of data, and it is probable that greater

precision may be spurious.

Research studies using soils and plant communities to model prehistoric occupation in Northeast Arkansas (Dekin et al. 1978; Morse 1981; Lafferty et al. 1984), in the adjacent portions of the Missouri Bootheel (Lewis 1974; Price and Price 1980), and in the lower Ohio Valley (Muller 1978, Lafferty 1977, Butler 1978) have all suggested that sites are preferentially located on levee soils and are not found in aquatic deposits.

MACROBIOTIC COMMUNITIES

"Macrobiotic" communities - levee, ecotone, and swamp - are composed of different species of plants and animals. Table 4 presents an arboreal species composition reconstructed in Mississippi County, Missouri (Lewis 1974:19-28).

Levee

The Levee Macrobiotic Community, which does not occur in the project area, includes two plant communities: (1) the Cottonwood-Sycamore community found along the active river channel and (2) the Sweetgum-Elm Cane Ridge forest on abandoned courses. The arboreal species found in the Sweetgum-Elm community include all of the species found along the natural levee, however, their mix is considerably different. These two communities are in the highest topographic position in the county and these areas also support a dense understory of plants including cane (Arundinaria gigantea), spice bush (Lindera Benzoin), pawpaw (Asimina triloba), trumpet creeper (Campsis radicans), red bud (Cercis canadensis), greenbrier (Smilax sp.), poison ivy (Rhus radicans) and a number of less frequent herbaceous plants. The most common of these was cane, which often formed nearly inpenetrable canebrakes. These provided cover for many of the larger species of land animals and were an important source of weaving and construction material.

The major mammals included in this biotic community included white-tailed deer (Odocoileus virginianus), cougar (Felis concolor), black bear (Ursus americanus), elk (Cervis canadensis), skunk (Mephitis mephitis), opossum (Didelphus marsupialis), raccoon (Procyon lotor), eastern cottontail rabbit (Sylvilagus floridanus), gray fox (Urocyon cinereoargenteus), and gray squirrel (Sciurus carolinensis). Important avian species included the wild turkey (Meleagris gallopavo), the prairie chicken (Tympanuchus cupido), ruffed grouse (Bonasa umbellus), passenger pigeon (Ectopistis migratorius) and Carolina paroquet (Conuropsis carolinensis).

Prior to artificial levee construction the natural levees were the best farmland in this environment, due to their location at the highest elevations from which the spring floods rapidly receded and drained. This environment provided for a large number of useful species of plants and animals, making it an attractive

place for settlement at virtually all times (except during floods) since the levees were laid down.

Table 2. Arboreal species composition of three biotic communities in Mississippi County, Missouri (percent per community)

Species	Levee	Edge	Swamp
American Elm (*Ulmus* sp.)	23	19	
Ash (*Fraxinus* sp.)	11	14	2
Bald Cypress (*Taxodium distichum*		7	50
Black Gum (*Nyssa sylvatica*)	T	1	
Blackhaw (*Viburnum* sp.)	T		
Black Walnut (*Juglans nigra*)	2		
Box Elder (*Acer Negundo*)	2		
Cherry (*Prunus* sp.)	T		
Cottonwood (*Populus* sp.)	1	3	
Dogwood (*Cornus* sp.)	1		
Hackberry (*Celtus occidentalis*)	12	9	
Hickory, (*Carya* sp.)	5	4	
Shellbark (*Carya laciniosa*)	T		
Hornbeam (*Ostrya virginiana*)	2		
Kentucky Coffee Tree(*Gymnocladus dioica*)	T		
Locust, ?	T		
Black (*Robinia pseudo-acacia*)	T		
Honey (*Gleditsia Triancanthos*)	T	1	14
Maple, (*Acer* sp.)	3	8	
Sugar (*Acer Saccharum*)	1		
Oak, Black (*Quercus velutina*)	5	2	
Burr (*Quercus macrocarpa*)	1	3	2
Overcup (*Quercus lyrata*)	1		
Post (*Quercus stellata*)	T		
Red (*Quercus rubra*)	1	1	
Spanish (*Quercus falcata*)	1		
Swamp (*Quercus bicolor*)	T	1	
White (*Quercus alba*)	1	1	
Pecan (*Carya illinoensis*)	1	1	
Persimmon (*Diospyros virginiana*)	T	2	2
Plum (*Prunus* sp.)	T		
Red Haw (*Crataegus* sp.)	T	1	11
Red Mulberry (*Morus rubra*)	T		
Sassafras (*Sassafras albidum*)	T		
Sweetgum (*Liquidamber styraciflua*)	20	18	
Sycamore (*Platanus occidentalis*)	1		
Willow (*Silix* sp.)	1	2	18

Abbreviations: T=Trace (i.e. <1%); W=known preferred wood; F= known Food Resource; D=Known drink resource. Data based on Lewis 1974:18-28.

Levee/Swamp Ecotone

The macrobiotic community Lewis (1974:24-25) has called the Sweetgum-Elm-Cypress Seasonal Swamp may have been in parts of the project area. This ecotone had few species present at any one time and a noticeably clear understory. The arboreal species composition (Table 4) includes more-water tolerant species (Cypress, Willow and Red Haw) and at times had aquatic animal species. Flooded regularly every year for several weeks to several months, the clay soils retained the moisture longer than on the levees. These locations were clearly much less desirable for year round occupation than were the levees, but were easy to traverse in dry periods.

Different fauna occupied the area seasonally, drawn from the adjacent swamps and levees. In addition the levee/swamp ecotone was a preferred habitat of the giant swamp rabbit (Sylvilagus aquaticus) and crawfish. It is probable that many aquatic species, such as fish, were stranded and scavenged by the omnivores of the forest during the changing of this environment from a wetland to a dry open swampscape. These soils are characteristically poorly drained due to the presence of clays in the upper horizons. In this environment normally aquatic trees, especially cypress, would have been exploitable with land-based technology.

Swamp

Included in this stratum are all of the different environments which were underwater prior to drainage. This is defined by all of the soils deposited in slackwater conditions, which are all low lying comprising the whole project area. the following different ecozones were included under this rubric before the drainage: river channels, lakes, marsh and cypress deep swamp. These are different successional stages in this environment, but all are aquatic. The only one of the three which has arboreal species is the Cypress Deep Swamp (Table 4).

Several important herbaceous species were found in these aquatic environments. These included cattails (Typha latifolia), various grape vines (Vitis sp.), button bush (Cephalanthus occidentalis), and hibiscus (Hibiscus sp.). The latter was an important source of salt (Morse and Morse 1980).

The fauna of the aquatic environment were quite different from the terrestrial species, which seldom penetrated beyond the edge of the swamp. Beaver, mink and otter were important swamp mammals. Of special interest were fish and waterfowl which were in large quantities in this great riverine flyway. In order to exploit these resources a means of water transportation is necessary, such as dugout canoes. They have been dated to at least 3000 BC and it is likely that they are a great deal earlier.

SURVEY CONDITIONS

The survey conditions present at the time of the BFD project vary according to which side of the ditch (north or south) one is on. For the sake of clarity and to facilitate the discussion of these conditions each side is discussed separately below.

South Side of Belle Fountain Ditch

The most prominent feature along the south side of BFD is the absence of a massive spoil pile given the size of the existing ditch. It was obvious that the spoil had been plowed down, increasing the plantable acreage. In light of Keller's (1983:106) observation that spoil from a ditch was often found to extend up 100 meters into the adjacent field, the north edge of the survey transect was inspected for evidence (fresh water snails and mussels) of this condition. This proved to be negative, however, concentrations of mussel shells were found 40 to 50 meters north of the north edge of the survey transect.

At the time of the project, surface conditions and visibility along the south side of BFD can be described as excellent. Surface visibility from the easternmost point of the survey transect (junction of BFD and Main Ditch 9) to .45 miles west of Missouri Highway NN was 100 percent. The ground had been disced and rained upon resulting in a ground surface completely void of any vegetation or crop remnants from the previous planting season.

Sparse grass was present from a point .45 miles west of Missouri Highway NN to the first dirt road east of the fish hatchery . Within this area, 2 spots (17 x 21 m and 14 x 19 m) possessed a surface visibility of less than 50 percent. The remaining area within this .45 miles had a surface visibility of 75 percent or greater. The rest of the survey transect had a surface visibility of 100 percent except for the area adjacent to and including the fish hatchery. The area taken in by the fish hatchery was not surveyed.

North Side of Belle Fountain Ditch

It was unclear at the time of the survey exactly how much of the survey transect was not covered by the spoil pile adjacent to BFD. It was estimated in the field that the base of the spoil pile was 25 to 40 meters wide. In addition to this a lateral (north of BFD) feeding into Main Ditch 1 paralleled BFD for the length of the survey transect.

From the maps provided for this project it was determined that the lateral paralleling BFD was within the survey transect and the north side needed to be inspected.

The area between BFD and the lateral had 90 to 100 percent surface visibility from the beginning point of the survey (station 293 + 63) west approximately 700 feet (213 m). The ground in this area is used for row crops and some minor concentrations of bean stalks and chaff were noted. In addition, the spoil pile was well formed with well established pasture present and a road on top of it. No evidence of the spoil pile having been plowed down was observed. From this point west to the end of the transect (station 250 + 71) at Main Ditch 1 surface visibility was zero percent due to the dense nature of the pasture present.

Surface visibility along the bank of the lateral was zero percent due to the presence of dense brush, small trees, and briars.

Surface visibility north of the lateral was 90 to 100 percent except for a restricted area east of Main Ditch 1. The area had been impacted by previous construction and maintenance of the lateral and Main Ditch 1. Dense vegetation and a large spoil pile were present.

SURVEY METHODS AND RESULTS

Given the limited variability present within the survey transects, the survey methods employed were straightforward and did not require any modification. Basically, a pedestrian style survey approach supplemented with shovel tests in areas with less than 75 percent surface visibility was employed (Figure 3). The discussion below outlines the spacing of crew members and the number of shovel tests for each side of BFD.

South Side of Belle Fountain Ditch

A shovel test 52 centimeters in depth was excavated within the survey transect when it was determined that the spoil pile had been plowed down. The shovel test was excavated to determine the presence or absence of soil from the spoil pile in the survey transect. The soil from this shovel test was dark greyish brown in color (10YR 4/2) and was a clay with no variation in color or soil texture. Characteristics common of soil originating from the spoil pile (heavily mottled, varying textures or soil types) were not present.

Given the narrow width (100') of the survey transect on the south side of BFD, crew members were spaced 20 meters apart. A surface inspection was conducted, except in 2 areas where surface visibility fell below 75 percent (See Survey Conditions). Two shovel tests were excavated to 52 and 53 centimeters below the surface (cmbs). The first shovel test (52 cmbs) had 2 distinct soil strata. The first stratum (0-8 cmbs) consisted of clay and was dark grayish brown (10YR 4/2) in color. The second stratum (8-52 cmbs) was a clay and dark brown (10YR 3/3) in color. The second shovel test was a repeat of the first except for a slight variation in the depths of the different strata. The first

stratum (0-11 cmbs) was a clay and dark grayish brown (10YR 4/2) in color. The second stratum (11-53 cmbs) was a clay and dark brown (10YR 3/3) in color.

No cultural resources were recorded within the survey transect along the south side of BFD.

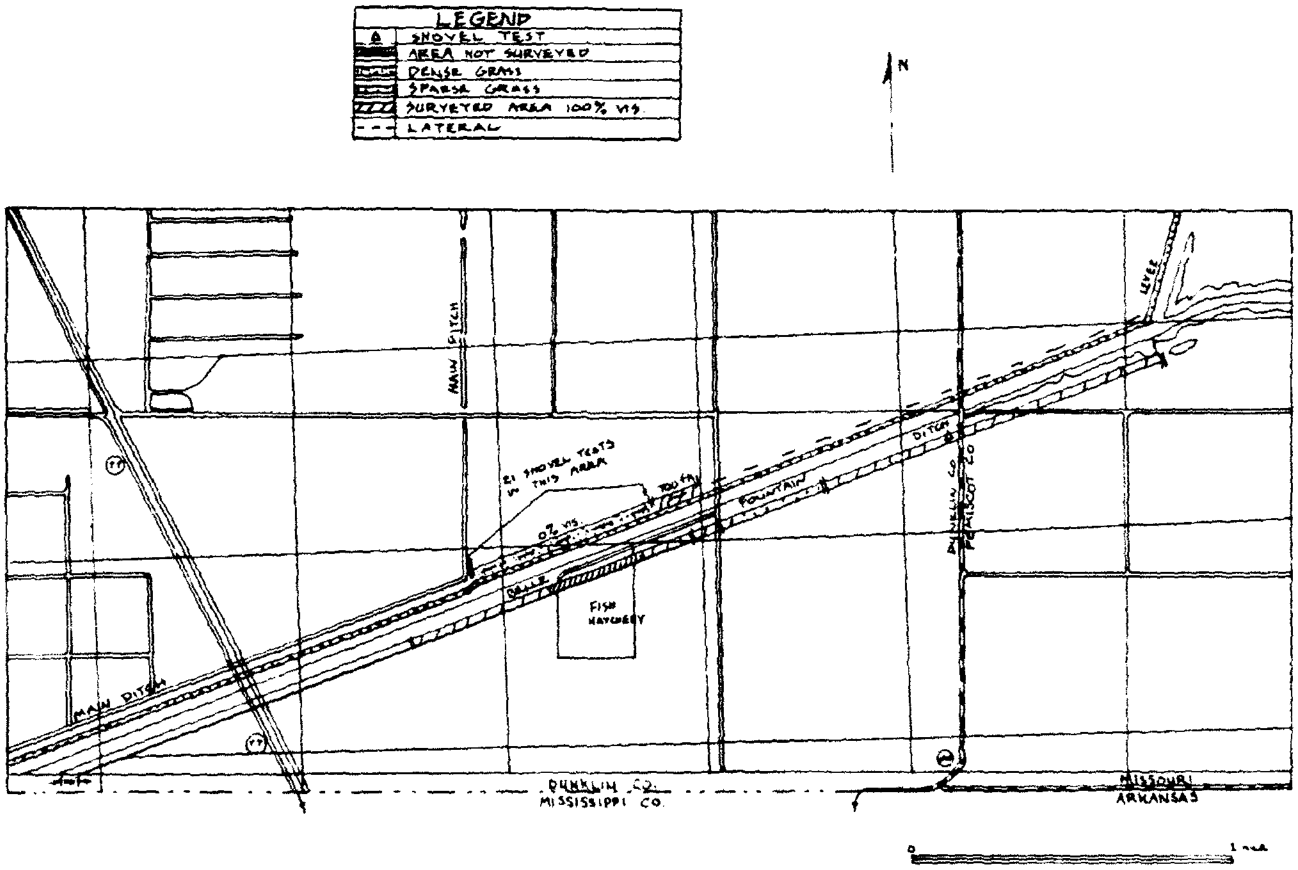

Figure 3. Areas surveyed and shovel tests.

North Side of Belle Fountain Ditch

From the starting point of the survey (between the lateral and BFD) to 700 feet (213 m) west a pedestrian style survey was conducted. Given the proximity of the lateral north of BFD, the BFD crew spacing of 20 meters was considered adequate to inspect this area. From a point 700 feet west of station 293 + 63, surface visibility dropped to zero percent requiring the excavation of shovel tests to a minimum of 50 centimeters below the surface every 30 meters. A total of 21 shovel tests were excavated with the soil being screened through 1/4" mesh hardware cloth (Table 1).

The area north of the lateral paralleling BFD was surveyed using the pedestrian method. Crew members were spaced between 20 and 25 meters apart.

No cultural resources were recorded within the survey transect along the north side of BFD.

Table 2. SHOVEL TESTS ALONG NORTH SIDE OF BELLE FOUNTAIN DITCH

Shovel Test	Stratum 1 color/depth/soil	Stratum 2 color/depth/soil
1	10YR4/2 0-8 clay	10YR3/3 8-50 clay
2	10YR4/3 0-9 clay	10YR3/3 9-50 clay
3	10YR4/2 0-9 clay	10YR3/3 9-52 clay
4	10YR4/2 0-11 clay	10YR3/2 11-51 clay
5	10YR4/2 0-12 clay	10YR3/2 12-52 clay
6	10YR4/1 0-10 clay	10YR3/3 10-51 clay
7	10YR4/2 0-11 clay	10YR3/3 11-50 clay
8	10YR4/2 0-9 clay	10YR3/3 9-51 clay
9	10YR4/1 0-11 clay	10YR3/3 11-50 sandy clay, slightly mottled
10	10YR4/1 0-11 clay	10YR3/2 11-54 clay
11	10YR4/1 0-12 clay	10Y$3/2 12-50 clay
12	10YR4/1 0-11 clay	10YR3/2 11-50 clay
13	10YR4/2 0-11 clay	10YR3/3 11-50 clay
14	10YR4/2 0-8 clay	10YR3/3 8-50 clay
15	10YR4/2 0-9 clay	10YR3/3 9-50 clay
16	10YR4/3 0-13 clay	10YR3/3 13-50 sandy clay slightly mottled
17	10YR4/3 0-12 clay	10YR3/3 12-51 sandy clay slightly mottled
18	10YR4/2 0-10 clay	10YR3/3 10-50 clay
19	10YR4/2 0-9 clay	10YR3/3 9-50 clay
20	10YR4/2 0-11 clayey sandy loam	10YR3/3 11-50 sandy clay slightly mottled
21	10YR4/2 0-12 clayey sandy loam	10YR3/3 12-52 sandy clay slightly mottled

PREVIOUS RESEARCH

INTRODUCTION

Archeological research has been carried out in Northeast Arkansas and Southeast Missouri for nearly a century (Table 3). As with much of the Mississippi Valley the earliest work was done by the Smithsonian Mound Exploration Project (Thomas 1894) which recorded the first site in the region. Most of these were the large mound groups. Since that time a great deal of work has been done in the Central Mississippi Valley area (cf. Willey and Phillips 1958 for definitions of technical terms) which has resulted in several extensive syntheses of the region's prehistory (Morse and Morse 1983; Chapman 1975, 1980). In this section we summarize the archeological research which has taken place, summarize what is known of the prehistory of the region and limits in these data as they apply to the project area. Finally we discuss what is known about the distribution of archeological sites in the region and discuss why no sites were found in this survey.

PREVIOUS ARCHEOLOGICAL RESEARCH

The earliest professional archeological work in the region was the work carried out by the mound exploration project of the Smithsonian Institution (Table 3). Thomas (1894) and his associates excavated at three sites near the project area: Taylor's Shanty, Tyronza Station and the Jackson Mounds. These were all Mississippi period sites located outside the project area. This work was principally excavation in large mound sites, and identified the American Indians as the authors of the great earthworks of the eastern United States.

Table 3. Previous Archeological Investigations in Northeast Arkansas and Southeast Missouri.

Investigator	Location and Contribution
Potter 1880	Archeological investigations in Southeast Missouri
Evers 1880	Study of pottery of southeast Missouri
Thomas 1894	Mound exploration in many of the large mound sites in SE Missouri, and northeast Arkansas
Fowke 1910	Mound excavation in the Morehouse Lowlands.
Moore 1910, 1911 1916	Excavation of large sites along the Mississippi, St. Francis, White and Black Rivers.
Adams and Walker 1942	Survey of New Madrid County
Walker and Adams 1946	Excavation of houses and palisade at the Mathews site
Phillips, Ford, and Griffin 1951; Phillips 1970	Mapped and sampled selected sites in SE Missouri, and NE Arkansas Lower Mississippi Valley Survey (LMVS), proposed ceramic chronology.
S. Williams 1954	Survey and excavation at several major sites in SE Missouri, original definition of several Woodland and Mississippi phases
Chapman and Anderson 1955	Excavation at the Campbell site, a large Late Mississippian Village in SE Missouri
Moselage 1962	Excavation at the Lawhorn site, a large Middle Mississippian Village in NE Arkansas
J. Williams 1964	Synthesis of fortified Indian villages in S. E. Missouri
Marshall 1965	Survey along I55 route, located and tested many sites east of project area
Morse 1968	Initial testing of Zebree and Buckeye Landing Sites

Table 3 (Continued). Previous Archeological Investigations

Reference	Location and Contribution
J. Williams 1968	Salvage of sites in connection with land leveling, Little River Lowlands
Redfield 1971	Dalton survey in Arkansas and Missouri Morehouse Lowlands
Schiffer & House 1975	Cache River survey
Price et al 1975	Little Black River survey
Morse and Morse 1976	Preliminary report on Zebree excavations
Chapman et al. 1977	Investigations at Lilbourn, Sikeston Ridge
Harris 1977	Survey along Ditch 19, Dunklin County, Missouri
Klinger and Mathis 1978	St. Francis II cultural resource survey in Craighead and Poinsett County, Arkansas
LeeDecker 1978	Cultural resources survey, Wappallo to Crowleys Ridge
Padgett 1978	Initial cultural resource survey of the Arkansas Power and Light Company transmission line from Keo to Dell, Arkansas
I. R. I. 1978	Cultural resources survey and testing, Castor River enlargement project.
Dekin et al 1978	Cultural resources overview and predictive model, St. Francis Basin
LeeDecker 1979	Cultural resources survey, Ditch 29, Dunklin Co, Missouri.
Morse 1979	Cultural resource survey inside Big Lake National Wildlife Refuge
J. Price 1979	Survey of Missouri and Arkansas Power Corporation power line in Dunklin County, Missouri
LeeDecker 1980a	Cultural resource survey, Ditch 81 control structure repairs

Table 3 (Continued). Previous Archeological Investigations

Reference	Location and Contribution
LeeDecker 1980b	Cultural resources survey, Upper Buffalo Creek Ditch, Dunklin County, Missouri and Mississippi County, Arkansas
Morse and Morse 1980	Final report to COE on Zebree project
J.Price 1980	Archeological investigations at 23DU244, limited activity Barnes site, Dunklin County Missouri
J. Price 1980	Cultural rsurvey, near St. Francis River, Dunklin County, Missouri
Price and Price 1980	A predictive model of archeological site frequency, transmission line, Dunklin County, Missouri
C. Price 1982	Cultural resource survey, runway extension, Kennett Airport, Dunklin County Missouri
Lafferty 1981	Cultural resource survey of route changes in AP&L Keo-Dell transmission line
J.Price and Perttula	Cultural resource survey of areas disturbed by sewer system, Arbyrd, Missouri
Klinger 1982	Mitigation of Mangrum site
Santeford 1982	Testing of 3CG713
Bennett and Higginbotham 1983	Mitigation at 23DU227, Late Archaic thru Mississippian site
Keller 1983	Cultural resources survey and literature review of Belle Fountain Ditch and tributaries
J. Price 1983	Phase II testing of Roo sites, Kennett Airport, Dunklin County, Missouri
J. & C Price 1984	Testing Shell Lake Site, Lake Wappapello

Table 3 (Continued). Previous Archeological Investigations

Reference	Location and Contribution
Chapman 1975, 1980	Synthesis of Archeology of Missouri
Morse and Morse 1983	Synthesis of Central Mississippi Valley prehistory
Lafferty et al. 1984, 1985	Cultural resource survey, testing and predictive model, Tyronza Watershed, Mississippi County, Arkansas

Most of the early work was concerned with the collection of specimens for museums (e.g.,Potter 1880; Moore 1910; Fowke 1910). Some of these data were used to define the great ceramic traditions in the eastern United States (Holmes 1903), including Mississippian. Many of these original conceptualizations are still the basis on which our current chronologies are structured (eg. Ford and Willey 1941; Griffin 1952; Chapman 1952, 1980).

There was a hiatus in the archeological work in the region until the 1940's when Adams and Walker began doing the first modern archeological work for the University of Missouri (Adams and Walker 1942; Walker and Adams 1946). Beginning in 1939 the Lower Mississippi Valley Survey (LMVS) conducted a number of test excavations at many of the large sites in the region (Phillips, Ford, and Griffin 1951; S. Williams 1954). This work has continued to the present in different parts of the valley (e.g., Phillips 1970; S. Williams 1984). The LMVS has produced definitions of many of the ceramic types in the Lower Mississippi Valley area and produced the first phase definitions for many of the archeological manifestations known in the latter part of the archeological record, particularly the Barnes, Baytown, and Mississippian traditions of the north (S. Williams 1954). The sites discovered on the Missouri side of the St Francis River in the project area are all of the known sites in the Missouri portion of the project area.

Beginning in the 1960's there has been an increase in the tempo and scope of archeological work carried out in the region. This has included a large number of survey and testing projects carried out with respect to proposed Federally funded projects (Marshall 1965; Williams 1968; Hopgood 1969; Krakker 1977; Gilmore 1979; IRI 1978, Dekin et al. 1978, Lafferty 1981; Morse and Morse 1976, 1980; Morse 1979; Klinger and Mathis 1978; Klinger 1982; Padgett 1978; C. Price 1976, 1979,, 1980; J. Price 1976a, 1976b, 1978; Greer 1978; LeeDecker 1979; Price, Morrow and Price

1978; Price and Price 1980; Santeford 1982; Sjoberg 1976; McNeil 1980, 1982, 1984; Klinger et al 1981). These projects are generally referred to as Cultural Resources Management studies and have greatly expanded the number of known sites from all periods of time. These projects have also produced a large body of data on the variation present, on a range of different sites, and have greatly increased our knowledge of this area.

Along with these small scale archeological projects there was a continuation of the large scale excavation projects carried out in the region. Major excavations at the Campbell site (Chapman and Anderson 1955), Lawhorn (Moselage 1962), Snodgrass site (Price 1973; Price and Griffin 1979), Lilbourn (Chapman et al 1977; Cottier 1977a, 1977b; Cottier and Southard 1977), and Zebree (Morse and Morse 1976, 1980) have greatly expanded our understanding of the Mississippian cultures. This understanding has resulted in the definition of the temporal/ spatial borders between different Woodland and Mississippian manifestations, and resulted in definitions of assemblages. Several major syntheses have resulted (Chapman 1975, 1980; Morse 1982a, 1982b; Morse and Morse 1983) which provide up-to-date summaries and interpretations of the work that has been carried out in the region.

PREVIOUS ARCHEOLOGICAL WORK IN THE BELLE FOUNTAIN DITCH

In 1983 New World Research, Inc., conducted a cultural resources survey and literature review of the Belle Fountain Ditch in Southeast Missouri and Northeast Arkansas. Part of this project involved survey of transects parallel to and between the MCRA project area and the ditch (Keller 1983). Keller found no archeological sites in this segment of Belle Fountain Ditch, which he attributed to the older surface being buried by more recent backwater swamp clays.

STATUS OF REGIONAL KNOWLEDGE

The above and other work in adjacent regions have resulted in the definition of the broad pattern of cultural history and prehistory in the region; however, knowledge of the region is still sketchy with few Archaic and Woodland sites having been excavated. This status has seriously constrained our understanding of settlement systems. Therefore, while this region may be fairly well known with respect to the Mississippi period, much more work needs to be done before the basic contents and definitions of many archeological units in space and time are adequate (cf. Morse 1982a). Presently we have a few key diagnostic types associated with some cultural units; however, the range of artifact assemblage variation across chronological and spatial boundaries are not yet defined, nor are the ranges of site types known for any of the defined units. The adequate definition and resolution of these fundamental questions and problems are necessary before we can begin to reconstruct and use the data for understanding more abstract cultural processes as is possible in better known archeological areas such as the American Southwest.

The Paleo-Indian period (10,000-8,500 B.C.) is known in the region from scattered projectile point finds over most of the area. These include nine Clovis and Clovis-like points from the Bootheel (Chapman 1975:93). No intact sites have yet been identified from this period, and the basal deposits of the major bluff shelters thus far excavated in the nearby Ozark Mountains have contained Dalton period assemblages. Lanceolate points are known from bluff shelters and high terraces (Sabo et al. 1982:54) which may represent different kinds of activities or extractive sites, as they have been shown to have been in other parts of the country. For the present any Paleo-Indian site in the region is probably significant.

The Dalton period (8,500-7,500 B.C.) is fairly well known in the Ozarks with modern controlled excavations from Rogers, Albertson, Tom's Brook, and Breckenridge shelters (McMillan 1971, Kay 1980; Dickson 1982; Logan 1952; Bartlett 1963, 1964; Wood 1963; Thomas 1969). Adjacent areas of the Lower Mississippi Valley have produced some of the better known Dalton components and sites in the central continent. These include the Sloan site (Morse 1973) and the Brand site (Goodyear 1974). These and other more limited or specialized excavations and analyses have resulted in the identification of a number of important Dalton tools (ie. Dalton points with a number of resharpening stages, a distinctive adze, spokeshaves and several varieties of unifacial scrapers, stone abraders, bone awls and needles, mortars, grinding stones and pestles. At least three different site types have been excavated: the bluff shelters, which were seasonal habitation sites, a butchering station (the Brand site) and a cemetery (Sloan site). Presently we do not have the other part(s) of the seasonal pattern which should be present in the region, nor have any other specialized activity sites been excavated. Dalton sites are known in a number of locations, especially on the edge of the Relict Braided Surface, on Crowley's Ridge, and the edge of the Ozark Escarpment. Given the present resource base there are a number of important questions which have been posed concerning the early widespread adaptation to this environment (Price and Krakker 1975; Morse 1982a, 1976).

The Early to Middle Archaic periods (7,500 - 3,000 B.C.) are best known from bluff shelter excavations in the Ozarks (Rogers, Jakie's, Calf Creek, Albertson, Breckenridge and Tom's Brook shelters). During this long period a large number of different projectile point types were produced (i.e. Rice Lobed, Big Sandy, White River Archaic, Hidden Valley Stemmed, Hardin Barbed, Searcy, Rice Lanceolate, Jakie Stemmed, and Johnson). No controlled excavations have been done at any Early or Middle Archaic site in southeast Missouri or northeast Arkansas (Chapman 1975:152). There are no radiocarbon dates for any of the Archaic period from southeast Missouri (Dekin et al 1978:78-79; Chapman 1980:234-238). The Middle Archaic archeological components are rare to absent in the Central Mississippi Valley (Morse and Morse 1983). Therefore, much of what we know of the archeological manifestations of this period is based on work in other regions, which has been extrapolated to the Mississippi Valley based on surface

finds of similar artifacts. At present, phases have not been defined.

The Late Archaic (3,000 B.C. - ~500 B.C.) appears to be a continuing adaptation to the wetter conditions following the dry Hypsithermal. This corresponds to the sub-Boreal climatic episode (Sabo et al. 1982). The lithic technologies appear to run without interruption through these periods with ceramics added about the beginning of the present era. Major excavations of these components have taken place at Poverty Point, and Jaketown in Louisiana and Mississippi (Ford, Phillips and Haag 1955, Webb 1968). A fairly large number of Late Archaic sites are known in eastern Arkansas and Missouri (Chapman 1975:177-179,224; Morse and Morse 1983:114-135). Major point types include Big Creek, Delhi, Pandale, Gary and Uvalde points. Other tools include triangular bifaces, manos, grinding basins, grooved axes, atlatl parts and a variety of tools carried over from the earlier periods such as scrapers, perforators, drills, knives and spokeshaves. Excavations at the Phillips Spring site has documented the presence of tropical cultigens (squash and gourd) by ~2,200 B.C. (Kay et al. 1980). The assemblages recovered in the bluff shelters from this time period indicate that there was a change in the use from general occupation to specialized hunting/butchering stations (Sabo et al. 1982:63). There are some indications of increasing sedentariness in this period, however, the range of site types have not been defined. Late Archaic artifacts are well known from the region, with artifacts usually present on any large multicomponent site. Our understanding of this period is limited to excavations from a few sites (Morse and Morse 1983; Lafferty 1981). At present we do not know the spatial limits of any phases (which have not been defined), nor do we have any control over variation in site types and assemblages.

Early Woodland (500 B.C.(?) - 150 B.C.). During this period there appears to have been a continuation of the lithic traditions from the previous period with an addition of pottery. As with the previous period this is a very poorly known archeological period with no radiocarbon dates for the early or beginning portions of the sequence. The beginning of the period is not firmly established and the termination is based on the appearance of Middle Woodland ceramics dated at the Burkett site (Williams 1974:21). The original definition of the Tchula period was made by Phillips, Ford and Griffin (1951:431-436). In the intervening time a fair amount of work has been done on Woodland sites. Chapman concludes that we are not yet able to separate the Early Woodland assemblages from the components preceding and following. At present there is considerable question if there is an Early Woodland period in S. E. Missouri (Chapman 1980:16-18). Recent work in northeast Arkansas, however, has identified ceramics which appear to be stylistically from this time period (Morse and Morse 1983; Lafferty et al 1985) and J. Price (personal communication) has identified a similar series of artifacts in the Bootheel region. Artifacts include biconical "Poverty Point objects," cordmarked pottery with noded rims similar to Crab Orchard pottery in Southern Illinois and the Alexander series

pottery in the Lower Tennessee Valley, and Hickory Ridge points.

Middle - Late Woodland periods (150 B.C.- A.D. 850) was a period of change. There is evidence of participation in the "Hopewell Interaction Sphere" (dentate and zone-stamped pottery, exotic shell; Ford 1963) and horticulture is increasing (corn, hoe chips and farmsteads). There is some mound construction notably the Helena mounds at the south end of Crowley's Ridge (Ford 1963) indicating greater social complexity. Typical artifacts include Snyder, Steuben, Dickson and Waubesa projectile points, and an increasing number of pottery types (cf. Rolingson 1984; Phillips 1970; Morse and Morse 1983). In the late Woodland there is an apparent population explosion as evidenced by a great number of sites with plain grog-tempered pottery in the east and Barnes sand-tempered pottery in the west of the Central Valley (Morse and Morse 1983; Chapman 1980). There is some evidence of architecture (cf. Morse and Morse 1983; Spears 1978) in this period as well as mound center construction (Rolingson 1984). A number of large open sites have not been excavated. There appears, therefore, to be a rather large bias in what we know about this important period toward the spectacular mound centers. There is still a great deal which is not understood about the cultural sequence and changes which came about during this important period. The Late Woodland in this area has been suggested as the underlaying precursor to the Mississippian, which came crashing into the area with the introduction (Invention ?; cf. Price and Price 1981) of shell-tempered pottery and the introduction of the bow and arrow around A. D. 850.

The Mississippi period (A.D. 850-1673) is known from the earliest investigations in the region (Thomas 1894; Holmes 1903; Moore 1916), and has been the most intensively investigated portion of the prehistoric record in northeast Arkansas and southeast Missouri (Chapman 1980; Morse and Morse 1983; Morse 1982; Morse 1981; House 1982). There has been enough work done that the spatial limits of phases have been defined (cf.Chapman 1980; Morse and Morse 1983; Morse 1981). During this period the native societies reached their height of development with fortified towns, organized warfare, more highly developed social organization, corn, bean and squash agriculture and extensive trade networks. The bow and arrow is common and there is a highly developed ceramic technology (cf. Lafferty 1977; Morse and Morse 1980; Smith 1978). This was abruptly terminated by the DeSoto entrada in the mid-16th century (Hudson 1984, 1985; Morse and Morse 1983) which probably passed through the project area.

Historic Period (1673-present). After the DeSoto expedition the area was not visited until the French opened the Mississippi valley in the last quarter of the 17th century. The Indian societies were a mere skeleton of their former glory and the population a fraction of those described by the DeSoto Chronicles.

During the French occupation most of the settlements were restricted to the major river courses with trappers and hunters living isolated lives in the headwaters of the many smaller creeks and rivers. The St. Francis River was one of the earliest explored tributaries of the Mississippi River in the Lower Mississippi Valley and appears on some of the earliest French maps.

The Euro-American occupation proceeded overland down Crowley's Ridge spreading out from the rivers. Ports were established at Piggott on the high ground of Crowley's Ridge in the St. Francis Gap in 1835. It was located on the Helena-Wittsburg road which ran down Crowley's Ridge (Dekin et al. 1978:358). All of the settlements in the 1830's between Piggott and Helena in the St. Francis Basin were either along the rivers or on Crowley's Ridge. Towns continued to be founded in these environments into the early 1900's. Settlements away from the rivers along overland roads began in the 1850's and greatly accelerated with the construction of the railroads, levees and drainage ditches in the late 19th century.

PREDICTIVE MODELS IN ARCHEOLOGY

The use of predictive models and many of the underlying assumptions are rooted in settlement analysis dating back to Willey's classic study in the Viru Valley, Peru (Willey 1953). In this study Willey traced the changes in settlement types and locations through several thousand years of prehistory. In a sense these were the beginning of predictive models because certain properties of types of sites were identified. In actuality, however, they were statements of empirical observation.

Since that pioneering work, settlement analysis has become an integral part of archeology (Chang 1958; Kurjack 1974; Harn 1971; Munson 1971; Adams 1965),and in more recent times have included analyses of the settlement systems often in conjunction with ecological systems (Muller 1978; Kurjack 1974; Peebles 1971; Smith 1978; Ward 1965; Winters 1969; Lewis 1974). These studies mark the beginning of establishing systematic relationships between archeological sites and particular environmental features such as levee soils, ecotones, and rivers.

In the 1970's, as a part of the "New Archeology" movement, attention has been paid to the factors which cause the perceived structures in the settlement systems (Gummerman 1971). Most of these analyses have involved making the Mini-Max assumption - people live where they can get maximum returns for minimum input - derived from Zipf's (1949) principal of least effort. This and other methods and approaches were borrowed from geographers who

had developed and continue to work with important methods of locational analysis (Chisolm 1970; Dacey 1966; Morrill 1962, 1968; Vining 1955) and explanatory theories (Bylund 1960; Christaller 1966, original 1933) for over a half century.

Locational analysis has been important in the formation of many of the concepts used in this study. There were several applications of the locational properties derived from geography used in archeological analysis (Crumley 1976; Lafferty 1977; Marcus 1973; Steponaitis 1978;) and site catchment analysis (Lafferty and Solis 1979; Peebles 1978; Roper 1974, 1975, 1979; Morse 1981). These studies, both successes and failures, have lead to a refinement of the methods and the underlying theory.

Along with a growing awareness that archeological sites are situated in particular kinds of environments, came the plotting of densities of archeological sites by ecozones in settlement pattern research (Gumerman 1971; Plog 1974) and in Cultural Resources Management studies (Mueller 1974; Schiffer and House 1975). The realization that these densities varied in different ecozones led to the premise that, if settlement models could be developed by surveying only a sample of a project area, then on large land-modifying projects such as reservoirs and strip mines, a great deal of time, money and human energy could be saved. Several projects used this approach (Klinger 1976) but were generally found to be unsuccessful. The best applications occur except for more restricted kinds of projects, where one simply had to identify environments where sites do not occur (Price and Price 1980) and recommended placement of the powerline or pipeline accordingly. The major problems with this approach were that the methods did not allow for the specificity that was required and, in general, the approach was too simplistic.

The current generation of models was developed from a synthesis of previous work (Lafferty 1977; Lafferty and Solis 1979; Limp 1978 and 1981) to construct practical models used to predict site locations over large surfaces for cultural resources management purposes (Lafferty et al. 1981, 1984; Lafferty and House 1984; Hay et al. 1982). This approach makes assumptions of Rational Choice Optimization theory (Arrow 1950, Limp, Lafferty and Scholtz 1981). These assumptions involve a more complex interrelationship of variation than was possible with the less sophisticated Mini-Max assumption (Limp 1980), and includes the recognition that different classes of human settlement are dependent on different kinds of variables (Lafferty 1977, 1980). Also there is the increasing sophistication of the statistics being employed which more closely approximate the reality of a complex environment.

Regression analysis was seen as a means of modeling the complex environments and their relation to archeological sites. These attempts also had several problems. The first problem was the use of the archeological site as the unit of analysis (Lafferty and Solis 1979). This was the normal procedure in settlement analysis, but it left the investigator not knowing what the

characteristics were of the locations without sites. How many locations were there with the same characteristics of those where sites were located which did not have archeological sites? This and other questions have important implications for how full the landscape was and other questions of theoretical importance. From a management point of view these models failed because they could not be applied to the unsurveyed portions of the project area (Lafferty and Solis 1979).

The desirability of encoding variables for an entire project area by some spatially controlled unit finally became apparent to several archeological investigators (Lafferty and Solis 1979; Limp 1980, 1981; Limp, Lafferty and Scholtz 1981; Hay et al. 1982). The implications of measuring environmental variation for the entire project area (statistical universe) are several and are just beginning to be understood. One important implication is that survey bias can now be precisely measured (Lafferty 1981:164-191). This is giving rise to new statistical applications to measure more precisely the goodness of fit of different variable distribution curves (Parker 1984; Lafferty 1984). Encoding the whole universe also allows for a precise application of the developed model to the whole universe (Lafferty et al 1981, 1984; Lafferty and House 1984; Hay et al 1982). The ongoing application of Geophysical Information Systems to this kind of predictive modeling is about to make the generation of the grids much less time consuming and will lead to an optimization of analysis unit size for different analyses and regions.

The early uses of regression analysis in settlement pattern analysis were accomplished to predict site size (Lafferty 1977) or the size of public investment in certain monuments (Stephonitis 1978). These were derived from Geography and econometrics. In the field, particularly in the wooded east, it was often impossible to determine site size, and linear regression analysis really was not the proper statistic. The Sparta predictive model made the first application of Multivariate Logistic Regression (Dunn n.d.; Scholtz 1980, 1981) which predicts a probability that an event will happen. This places the normal regression formula in an exponent in the denominator and results in a probability that there will be a site on a given unit of land. A less satisfactory solution has been to make the predicted variable be a percent of shovel tests with archeological materials (Hay et al. 1982).

To date, the development of predictive models over the past 35 years has resulted in delimiting a successful, statistically adequate set of procedures for predicting site locations which are theoretically adequate. At the present time, the two tests which have been made of the theory have failed to refute it (Lafferty 1977; Lafferty and House 1984).

The development of predictive models over the past 15 years has resulted in several procedures and approaches which to date have been successful. Basic requirements for predictive models

include:

(1) a grid laid over the project area for spatial control with standard sized Units of Analysis

(2) a representative sample survey of the project area (statistically it is desirable that more than 30 units have sites in them)

(3) a selection of variables which influence settlement in the environment

(4) the set of variables input into the computer matrix for each Unit of Analysis

(5) an analysis of variable matrix for redundancy using factor analysis and/or correlation coefficients;

(6) an application of logistic regression to develop a model of site probabilities

(7) the application of the model to the unsurveyed universe to map probabilities which can then be used to guide further survey and project goals.

PREDICTIVE MODELS IN THE CENTRAL MISSISSIPPI VALLEY

There has, in fact, been more predictive modeling work done in this basin than anywhere else in the southeast. The three predictive models developed in the St. Francis Basin are directly relevant to our analysis.

The first was the effort carried out by Iroquois Research Institute (IRI): Predicting Cultural Resources in the St. Francis River Basin: A Research Design (Dekin et al. 1978). This study which included the whole basin, outlined the known data base, defined major environmental variation, and outlined what kinds of data are required to develop a predictive model in the basin as a whole but failed to make useful predictions. Various correlations were drawn between various physiographic features such as distance to water and depositional environments/soils. While backswamps were found to have the lowest density of sites, the density of components is erroneously derived by dividing the number of known components per physiographic zone by the total area in that zone, rather than the area surveyed (Dekin et al 1978:94-108). This results in a much lower estimate of site densities than have been found on other surveys and brings out the problems of areal control when using archival data where the area surveyed is not known. Over 2/3 of the sites came from meander belts and relict braided surface locations (2268/3,113) while almost no sites are known from backwater swamps (9/3,113). The area surveyed in obtaining these results is not known and, therefore, the densities given for the different zones have no meaning (Dekin et al 1978:94 and 108). While the densities are

erroneous as confirmed by later work, the relative tendencies for more sites to be located on the IRI high density areas have been confirmed by later work.

In 1979 Price carried out a survey of the Missouri-Arkansas Power line and then developed a model which predicted that the least probable location for sites were on slackwater soils (Price and Price 1980). This model was used in the final planning of the power line in Missouri.

Between 1983 and 1985 Mid-Continental Research Associates conducted cultural resources survey over 95 miles of ditches in the Tyronza Basin for the Soil Conservation Service (Lafferty et al. 1984, 1985). This was a scientifically drawn statistical sample which predicted the specific probability that there would be a site on each 10 acre (4 ha) unit of the project area. This model is directly applicable to the present project area. This model used logistic regression (Dunn n.d.) to model areal resources. The model predicts that sites are found on higher levee soils near water. Sharkey clays have the lowest potential for sites.

This analysis indicates that the Belle Fountain Ditch has a low potential for archeological sites. The whole project area was historically in a swamp until it was drained early in this century. Four different models developed on independent data bases indicate that these soils are unlikely site locations in predrainage landscapes. There is no evidence of central places and there are no point bound resources. Even today, areally bound places (farm houses) are rare in the poorly drained environs of the ditch. The actual site survey of the project area produced no archeological sites. While it is possible that there are sites buried in the clay, present evidence indicates that Big Lake is deep and perhaps spans most of the Holocene and has a low probability for archeological sites in its clays.

RECOMMENDATION

All lines of evidence in this project indicate that there is virtually no chance for predrainage houses in this project area. The search of the records, archeological survey, and analysis of the relevant predictive models all indicate that this whole ditch is a low probability area for site locations. We recommend that no further archeological work be conducted in connection with this project.

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APPENDIX A

LIST OF PROJECT PERSONNEL

Amy Hess	Drafter
Kathleen M. Hess	Lab Director/typist
Kathryn King	Lab technician/typist
Robert H. Lafferty III	Principle investigator/report author
Barbara Lisle	Field crew member
Mary Printup	Editor
Michael Sierzchula	Project archeologist/ report author

APPENDIX B

SCOPE OF WORK

DESCRIPTION/SPECIFICATIONS (SCOPE OF WORK)

A-1. GENERAL.

A-1.1. The Contractor shall conduct a background and literature search, an intensive survey investigation and initial site testing along Belle Fountain Ditch in Dunklin and Pemiscot Counties, Missouri. Reports of these investigations shall be submitted. These tasks are in partial fulfillment of the Memphis District's obligations under the National Historic Preservation Act of 1966 (P.L. 89-665), as amended; the National Environment Policy Act of 1969 (P.L. 91-190); Executive Order 11593, "Protection and Enhancement of Cultural Environment." 13 May 1971 (36 CFR Part 800); Preservation of Historic and Archeological Data. 1974 (P.L. 93-291), as amended; and the Advisory Council on Historic Preservation, "Procedures for the Protection of Historic and Cultural Properties" (36 CFR Part 800).

A-1.2. Areas immediately adjacent to the study area were examined by New World Research, Inc. in 1983. Results of these investigations were reported in Cultural Resource Survey and Literature Review of Belle Fountain Ditch and Tributaries, Dunklin and Pemiscot Counties, Missouri and Mississippi County, Arkansas by John E. Keller. This report, copies of which can be obtained from the Memphis District, contains much of the needed data necessary for the background and literature search required by this contract. As pointed out in this report (pp. 60-61), much of the area in the vicinity of the present contract study area has undergone severe disturbance.

A-1.3. Personnel Standards.

a. The Contractor shall utilize a systematic. interdisciplinary approach to conduct the study. Specialized knowledge and skills will be used during the course of the study to include expertise in archeology, history, architecture, geology and other disciplines as required to fulfill requirements of this Scope of Work. Techniques and methodologies used for the study shall be representative of the state of current professional knowledge and development.

b. The following minimal experiential and academic standards shall apply to personnel involved in investigations described in this Scope of Work:

(1) Archeological Project Directors or Principal Investigator(s) (PI). Individuals in charge of an archeological project or research investigation contract, in addition to meeting the appropriate standards for archeologist, must have a publication record that demonstrates extensive experience in successful field project formulation, execution and technical monograph reporting. Changes in any Project Director or Principal Investigator must be approved by the Contracting Officer. The Contracting Officer may require suitable professional references to obtain estimates regarding the adequacy of prior work.

(2) Archeologist. The minimum formal qualifications for individuals practicing archeology as a profession are a B.A. or B.S. degree from an accredited college or university, followed by a minimum of two years of successful graduate study or equivalent with concentration in anthropology

and specialization in archeology and at least two summer field schools or their equivalent under the supervision of archeologists of recognized competence. A Master's thesis or its equivalent in research and publication is highly recommended, as is the M.A. degree.

(3) Architectural Historian. The minimum professional qualifications in architectural history are a graduate degree in architectural history, historic preservation, or closely related fields, with course work in American architectural history; or a bachelor's degree in architectural history, historic preservation, or closely related field plus one of the following:

(a) At least two years full-time experience in research, writing, or teaching in American history or restoration architecture with an academic institution, historical organization or agency, museum, or other professional institution; or

(b) Substantial contribution through research and publication to the body of scholarly knowledge in the field of American architectural history.

(4) Other Professional Personnel. All other personnel utilized for their special knowledge and expertise must have a B.A. or B.S. degree from an accredited college or university, followed by a minimum of two years of successful graduate study with concentration in appropriate study and a publication record demonstrating competence in the field of study.

(5) Other Supervisory Personnel. Persons in any supervisory position must hold a B.A., B.S. or M.A. degree with a concentration in the appropriate field of study and a minimum of 2 years of field and laboratory experience in tasks similar to those to be performed under this contract.

(6) Crew Members and Lab Workers. All crew members and lab workers must have prior experience compatible with the tasks to be performed under this contract. An academic background in the appropriate field of study is highly recommended.

c. All operations shall be conducted under the supervision of qualified professionals in the discipline appropriate to the data that is to be discovered, described or analyzed. Vitae of personnel involved in project activities may be required by the Contracting Officer at anytime during the period of service of this contract.

A-1.4. The Contractor shall designate in writing the name or names of the Principal Investigator(s). Participation time of the Principal Investigator(s) shall average a minimum of 50 hours per month during the period of service of this contract. In the event of controversy or court challenge, the Principal Investigator shall be available to testify with respect to report findings. The additional services and expenses would be at Government expense, per paragraph 1.8 below.

A-1.5. The Contractor shall keep standard field records which may be reviewed by the Contracting Officer. These records shall include field notes, appropriate state site survey forms and any other cultural resource

forms and/or records, field maps and photographs necessary to successfully implement requirements of this Scope of Work.

A-1.6. To conduct the field investigation, the Contractor will obtain all necessary permits, licenses; and approvals from all local, state and Federal authorities. Should it become necessary in the performance of the work and services of the Contractor to secure the right of ingress and egress to perform any of the work required herein on properties not owned or controlled by the Government, the Contractor shall secure the consent of the owner, his representative, or agent, prior to effecting entry on such property.

A-1.7. Innovative approaches to data location, collection, description and analysis, consistent with other provisions of this contract and the cultural resources requirements of the Memphis District, are encouraged.

A-1.8. No mechanical power equipment shall be utilized in any cultural resource activity without specific written permission of the Contracting Officer.

A-1.9. The Contractor shall furnish expert personnel to attend conferences and furnish testimony in any judicial proceedings involving the archeological and historical study, evaluation, analysis and report. When required, arrangements for these services and payment therefor will be made by representatives of either the Corps of Engineers or the Department of Justice.

A-1.10. The Contractor, prior to the acceptance of the final report, shall not release any sketch, photograph, report or other material of any nature obtained or prepared under this contract without specific written approval of the Contracting Officer.

A-1.11. The extent and character of the work to be accomplished by the Contractor shall be subject to the general supervision, direction, control and approval of the Contracting Officer. The Contracting Officer may have a representative of the Government present during any or all phases of Scope of Work requirements.

A-1.12. The Contractor shall obtain Corps of Engineers Safety Manual (EM 385 -1-1) and comply with all appropriate provisions. Particular attention is directed to safety requirements relating to the deep excavation of soils.

A-1.13. There will be two categories of meetings between Contractor and Contracting Officer: (1) scheduled formal conferences to review contract performance, and (2) informal, unscheduled meetings for clarification, assistance, coordination and discussion. The initial meeting shall be held prior to the beginning of field work. Category (1) meetings will be scheduled by the Contracting Officer and will be held at the most convenient location, to be chosen by the Contracting Officer. This may sometimes be on the project site, but generally will be at the office of the Contracting Officer.

A-2. STUDY AREA.

The study area situated along Belle Fountain Ditch in Dunklin and Pemiscot counties, Missouri extending from the junction of Belle Fountain Ditch and the New Connecting Ditch, Lateral No. 27 (at mile 2.50) to the junction of Belle Fountain Ditch and Main Ditch No. 9 (at mile 6.29), a linear distance of approximately 3.79 miles (6.10 kilometers). The area to be examined consists of a transect paralleling Belle Fountain Ditch beginning 300 feet from the south bank of the Ditch and extending to 400 feet from the south top bank (a width of 100 feet). In addition, the study area includes a transect extending from station 250+71 to station 293+63 (see attached Drawing, File 41L/299(1)) paralleling the north top bank and extending from the north top bank landward for 300 feet (91.4 meters).

A-3. DEFINITIONS.

A-3.1. "Cultural resources" are defined to include any building, site, district, structure, object, data, or other material relating to the history, architecture, archeology, or culture of an area.

A-3.2. "Background and Literature Search" is defined as a comprehensive examination of existing literature and records for the purpose of inferring the potential presence and character of cultural resources in the study area. The examination may also serve as collateral information to field data in evaluating the eligibility of cultural resources for inclusion in the National Register of Historic Places or in ameliorating losses of significant data in such resources.

A-3.3. "Intensive Survey" is defined as a comprehensive, systematic, and detailed on-the-ground survey of an area, of sufficient intensity to determine the number, types, extent and distribution of cultural resources present and their relationship to project features.

A-3.4. "Mitigation" is defined as the amelioration of losses of significant prehistoric, historic, or architectural resources which will be accomplished through preplanned actions to avoid, preserve, protect, or minimize adverse effect upon such resources or to recover a representative sample of the data they contain by implementation of scientific research and other professional techniques and procedures. Mitigation of losses of cultural resources includes, but is not limited to, such measures as: (1) recovery and preservation of an adequate sample of archeological data to allow for analysis and published interpretation of the cultural and environmental conditions prevailing at the time(s) the area was utilized by man; (2) recording, through architectural quality photographs and/or measured drawings of buildings, structures, districts, sites and objects and deposition of such documentation in the Library of Congress as a part of the National Architectural and Engineering Record; (3) relocation of buildings, structures and objects; (4) modification of plans or authorized projects to provide for preservation of resources in place; (5) reduction or elimination of impacts by engineering solutions to avoid mechanical effects of wave wash, scour, sedimentation and related processes and the effects of saturation.

A-3.5. "Reconnaissance" is defined as an on-the-ground examination of selected portions of the study area, and related analysis adequate to assess

the general nature of resources in the overall study area and the probable impact on resources of alternate plans under consideration. Normally reconnaissance will involve the intensive examination of not more than 15 percent of the total proposed impact area.

A-3.6. "Significance" is attributable to those cultural resources of historical, architectural, or archeological value when such properties are included in or have been determined by the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places after evaluation against the criteria contained in 36 CFR 63.

A-3.7. "Testing" is defined as the systematic removal of the scientific, prehistoric, historic, and/or archeological data that provide an archeological or architectural property with its research or data value. Testing may include controlled surface survey, shovel testing, profiling, and limited subsurface test excavations of the properties to be affected for purposes of research planning, the development of specific plans for research activities, excavation, preparation of notes and records, and other forms of physical removal of data and the material analysis of such data and material, preparation of reports on such data and material and dissemination of reports and other products of the research. Subsurface testing shall not proceed to the level of mitigation.

A-3.8. "Analysis" is the systematic examination of material data, environmental data, ethnographic data, written records, or other data which may be prerequisite to adequately evaluating those qualities which contribute to their significance.

A-4. GENERAL PERFORMANCE SPECIFICATIONS.

A-4.1. Research Design.

Survey and testing will be conducted within the framework of a regional research design including, where appropriate, questions discussed in the State Plan. All typological units not generated in these investigation, shall be adequately referenced. It should be noted that artifactual typologies constructed for other areas may or may not be suitable for use in the study area. It is, therefore, of great importance that considerable effort be spent in recording and describing artifactual characteristics treated as diagnostic in this study as well as explicit reasons for assigning (or not assigning) specific artifacts to various classificatory units.

A-4.2. Background and Literature Search.

a. This task shall include an examination of the historic and prehistoric environmental setting and cultural background of the study area and shall be of sufficient magnitude to achieve a detailed understanding of the overall cultural and environmental context of the study area. It is axiomatic that the background and literature search shall normally preceed the initiation of all fieldwork.

b. Information and data for the literature search shall be obtained, as appropriate, from the following sources: (1) Scholarly reports - books, journals, theses, dissertations and unpublished papers; (2) Official Records

- Federal, state, county and local levels, property deeds, public works and other regulatory department records and maps; (3) Libraries and Museums - both regional and local libraries, historical societies, universities, and museums; (4) Other repositories - such as private collections, papers, photographs, etc.; (5) Archeological site files at local universities, the State Historic Preservation Office, the office of the State Archeologist; (6) Consultation with qualified professionals familiar with the cultural resources in the area, as well as consultation with professionals in associated areas such as history, sedimentology, geomorphology, agronomy, and ethnology.

c. The Contractor shall include as an appendix to the draft and final reports, written evidence of all consultation and any subsequent responses(s), including the dates of such consultation and communications.

d. The background and literature search shall be performed in such a manner as to facilitate the construction of predictive statements (to be included in the study report) concerning the probable quantity, character, and distribution of cultural resources within the project area. In addition, information obtained in the background and literature search should be of such scope and detail as to serve as an adequate data base for subsequent field work and analysis in the study area undertaken for the purpose of discerning the character, distribution and significance of specific identified cultural resources.

e. In order to accomplish the objectives described in paragraph A-4.2.d., it will be necessary to attempt to establish a relationship between landforms and the patterns of their utilization by successive groups of human inhabitants. This task should involve defining and describing various zones of the study area with specific reference to such variables as past topography, potential food resources, soils, geology, and river channel history.

A-4.3. Intensive Survey.

a. Intensive survey shall include the on-the-ground examination of the study areas described in paragraph A-2.

b. Unless excellent ground visability and other conditions conducive to the observation of cultural evidence occurs, shovel test pits, or comparable subsurface excavation units, shall be installed at intervals no greater than 30 meters throughout the study area. Note that auger samples, probes, and coring tools will not be considered comparable subsurface units. Shovel test pits shall be minimally 30 x 30 centimeters in size and extend to a minimum depth of 50 centimeters. Unit fill material shall be screened using 1/4" mesh hardware cloth. Additional shovel test pits shall be excavated in areas judged by the Principal Investigator to display a high potential for the presence of cultural resources. If, during the course of intensive survey activities, areas are encountered in which disturbance or other factors clearly and decisively preclude the possible presence of significant cultural resources, the Contractor shall carefully examine and document the nature and extent of the factors and then proceed with survey activities in the remainder of the study area. Documentation and justification of such action shall appear in the survey report. The location of all shovel test units and surface observations shall be recorded.

A-4.4. Resource Recordation and Examination.

(1) When cultural remains are encountered, horizontal site boundaries shall be derived by the use of surface observation procedures in such a manner as to allow precise location of site boundaries on Government project drawings and 7.5 minute U.S.G.S. quad maps when available. Methods used to establish site boundaries shall be discussed in the survey report together with the probable accuracy of the boundaries. The Contractor shall establish a datum at the discovered cultural loci which shall be precisely related to the site boundaries as well as to a permanent reference point (in terms of azimuth and distance) by means of a transit level. If possible, the permanent reference point used shall appear on Government blueline (project) drawings and/or 7.5 minute U.S.G.S. quad maps. If no permanent landmark is available, a permanent datum shall be established in a secure location for use as a reference point. The permanent datum shall be precisely plotted and shown on U.S.G.S. quad maps and project drawings. All descriptions of site location shall refer to the location of the primary site datum.

(2) All standing buildings and structures (other than those patently modern, i.e., less than 50 years old) shall be recorded and described. For a building to be considered "standing" it must retain four walls and at least a skeletal roof structure. A building or structure found in the field to be partially or totally collapsed will be considered an archeological site. In these cases, data concerning construction materials and techniques and floor plan, if discernible, must be collected. The Contractor shall supply preliminary information concerning the suitability of a structure or building for relocation and restoration (structural soundness for example).

(3) Examination of cultural loci shall be sufficient to supply all information, including precise boundary information, needed to fill in state archeological site forms or/ architectural property survey forms as appropriate.

(4) Cultural Resource Recording and Numbering. For each archeological site or architectural property recorded during the survey, the Contractor shall complete and submit the standard Missouri archeological site or architectural property survey form, respectively. The Contractor shall be responsible for reproducing or obtaining a sufficient quantity of these forms to meet the needs of the project. The Contractor shall be responsible for coordinating with the appropriate state agency to obtain state site file numbers for each archeological site and architectural property recorded.

A-4.5. Laboratory Processing, Analysis, and Preservation.

All cultural materials recovered will be cleaned and stored in deterioration resistant containers suitable for long term curation. Diagnostic artifacts will be labeled and catalogued individually. A diagnostic artifact is defined herein as any object which contributes individually to the needs of analysis required by this Scope of Work or the research design. All other artifacts recovered must minimally be placed in labeled, deterioration resistant containers, and the items catalogued. The

Contractor shall describe and analyze all cultural materials recovered in accordance with current professional standards. Artifactual and non-artifactual analysis shall be of an adequate level and nature to fulfill the requirements of this Scope of Work. All recovered cultural items shall be catalogued in a manner consistent with Missouri state requirements. The Contractor shall consult with appropriate state officials as soon as possible following the conclusion of field work in order to obtain information (ex: accession numbers) prerequisite to such cataloging procedures.

Efforts to insure the permanent curation of properly cataloged cultural resources materials and project documentation in an appropriate institution shall be considered an integral part of the requirements of this Scope of Work. The Contractor shall pay all cost of the preparation and permanent curation of records and artifacts. An arrangement for curation shall be confirmed by the Contractor, subject to the approval of the Contracting Officer, prior to the acceptance of the final report.

A-5. GENERAL REPORT REQUIREMENTS.

A-5.1. The primary purpose of the cultural resources report is to serve as a planning tool which aids the Government in meeting its obligations to preserve and protect our cultural heritage. The report will be in the form of a comprehensive, scholarly document that not only fulfills mandated legal requirements but also serves as a scientific reference for future cultural resources studies. As such, the report's content must be not only descriptive but also analytic in nature.

A-5.2. Upon completion of all field investigation and research, the Contractor shall prepare a report detailing the work accomplished, the results, and recommendations for each project area. Copies of the draft and final reports of investigation shall be submitted in a form suitable for publication and be prepared in a format reflecting contemporary organizational and illustrative standards for current professional archeological journals. The final report shall be typed on standard size 8-1/2" x 11" bond paper with pages numbered and with page margins one inch at top, bottom, and sides. Photographs, plans, maps, drawings and text shall be clean and clear.

A-5.3. The report shall include, but not necessarily be limited to, the following sections and items:

a. Title Page. The title page should provide the following information; the type of task undertaken, the study areas and cultural resources which were assessed; the location (county and state), the date of the report; the contract number; the name of the author(s) and/or the Principal Investigator; and the agency for which the report is being prepared. If a report has been authored by someone other than the Principal Investigator, the Principal Investigator must at least prepare a foreword describing the overall research context of the report, the significance of the work, and any other related background circumstances relating to the manner in which the work was undertaken.

b. Abstract. An abstract suitable for publication in an abstract journal shall be prepared and shall consist of a brief, quotable summary useful for informing the technically-oriented professional public of what the author considers to be the contributions of the investigation to knowledge.

c. Table of Contents.

d. Introduction. This section shall include the purpose of the report, a description of the proposed project, a map of the general area, a project map, and the dates during which the investigations were conducted. The introduction shall also contain the name of the institution where recovered materials and documents will be curated.

e. Environmental Context. This section shall contain, but not be limited to, a discussion of probable past floral, faunal, and climatic characteristics of the project area. Since data in this section may be used in the evaluation of specific cultural resource significance, it is imperative that the quantity and quality of environmental data be sufficient to allow subsequent detailed analysis of the relationship between past cultural activities and environmental variables.

f. Previous Research. This section shall describe previous research which may be useful in deriving or interpreting relevant background data, problem domains, or research questions and in providing a context in which to examine the probability of occurrence and significance of cultural resources in the study area.

g. Literature Search and Personal Interviews. This section shall discuss the results of the literature search, including specific data sources, and personal interviews which were conducted during the course of investigations.

i. Survey, Testing and Analytical Methods. This section shall contain an explicit discussion of the research design, and shall demonstrate how environmental data, previous research data, the literature search and personal interviews have been utilized in constructing the strategy. Specific research domains and questions as well as methodological strategies employed to address those questions should be included where possible.

j. Recommendations.

(1) This section should contain, where possible, assessments of the eligibility of specific cultural properties in the study area for inclusion in the National Register of Historic Places.

(2) Significance should be discussed explicitly in terms of previous regional and local research and relevant problem domains. Statements concerning significance shall contain a detailed, well-reasoned argument for the property's research potential in contributing to the understanding of cultural patterns, processes or activities important to the history or prehistory of the locality, region or nation, or other criteria of significance. Conclusions concerning insignificance likewise, shall be fully documented and contain detailed and well-reasoned arguments as to why the

property fails to display adequate research potential or other characteristics adequate to meet National Register criteria of significance. For example, conclusions concerning significance or insignificance relating solely to the lack of contextual integrity due to plow disturbance or the lack of subsurface deposits will be considered inadequate. Where appropriate, due consideration should be given to the data potential of such variables as site functional characteristics, horizontal intersite or intrasite spatial patterning of data and the importance of the site as a representative systemic element in the patterning of human behavior. All report conclusions and recommendations shall be logically and explicitly derived from data discussed in the report.

(3) The significance or insignificance of cultural resources can be determined adequately only within the context of the most recent available local and regional data base. Consequently the evaluation of specific individual cultural loci examined during the course of contract activities shall relate these resources not only to previously known cultural data but also to a synthesized interrelated corpus of data including those data generated in the present study.

(4) Where appropriate, the Contractor shall provide alternative mitigation measures for significant resources which will be adversely impacted. Data will be provided to support the need for mitigation and the relative merits of each mitigation design will be discussed. Preservation of significant cultural resources is nearly always considered preferable to recovery of data through excavation. When a significant site can be preserved for an amount reasonably comparable to, or less than the amount required to recover the data, full consideration shall be given to this course of action.

k. References (American Antiquity Style).

l. Appendices (Maps, Correspondence, etc.). A copy of this Scope of Work and, when stipulated by the Contracting Officer, review comments shall be included as appendices to the final report of investigations.

A-5.4. The above items do not necessarily have to be discrete sections; however, they should be readily discernible to the reader.

A-5.5. In order to prevent potential damage to cultural resources, no information shall appear in the body of the report which would reveal precise resource location. All maps which indicate or imply precise site locations shall be included in reports as a readily removable appendix (e.g. envelope).

A-5.6. No logo or other such organizational designation shall appear in any part of the report (including tables or figures) other than the title page.

A-5.7. Unless specifically otherwise authorized by the Contracting Officer, all reports shall utilize permanent site numbers assigned by the state in which the study occurs.

A-5.8. All appropriate information (including typologies and other classificatory units) not generated in these contract activities shall be suitably referenced.

A-5.9. Reports shall contain site specific maps. Site maps shall indicate site datum(s), location of data collection units (including shovel cuts, subsurface test units and surface collection units), site boundaries in relation to proposed project activities, site grid systems (where appropriate), and such other items as the Contractor may deem appropriate to the purposes of this contract.

A-5.10. Information shall be presented in textual, tabular, and graphic forms, whichever are most appropriate, effective and advantageous to communicate necessary information. All tables, figures and maps appearing in the report shall be of publishable quality.

A-5.11. Any abbreviated phrases used in the text shall be spelled out when the phrase first occurs in the text. For example use "State Historic Preservation Officer (SHPO)" in the initial reference and thereafter "SHPO" may be used.

A-5.12. The first time the common name of a biological species is used it should be followed by the scientific name.

A-5.13. In addition to street addresses or property names, sites shall be located on the Universal Transverse Mercator (UTM) grid.

A-5.14. Generally, all measurements should be metric.

A-5.15. As appropriate, diagnostic and/or unique artifacts, cultural resources or their contexts shall be shown by drawings or photographs.

A-5.16. Black and white photographs are preferred except when color changes are important for understanding the data being presented. No instant type photographs may be used.

A-5.17. Negatives of all black and white photographs and/or color slides of all plates included in the final report shall be submitted to the Contracting Officer.

A-6. SUBMITTALS.

A-6.1. An extensive management summary shall be submitted, in accordance with the schedule in paragraph A-7.1, to the Contracting Officer within 10 days of the completion of survey and initial testing. The management summary shall describe survey and initial testing methods and the data yielded by those methods. Where survey data, initial testing data and other sources of data are adequate, the Contractor shall evaluate cultural resources identified during survey activities in terms of eligibility for inclusion in the National Register of Historic Places. The evaluation shall be consistent with requirements in paragraph A-5.3.j. of this Scope of Work. Where inadequate data exist for such an evaluation, the Contractor shall recommend specific additional studies, as described in paragraph A-4.4.b. of this Scope of Work, necessary to obtain adequate data for such National

Register evaluation. The management summary shall include project maps showing boundaries of discovered cultural resources relative to project rights-of-way.

A-6.2. The Contractor shall submit 8 copies of the draft report and one original and 30 copies with high quality binding, of the final report which include appropriate revisions in response to the Contracting Officer's comments.

A-6.3. The Contractor shall submit under separate cover 4 copies of appropriate 15' quadrangle maps (7.5' when available) or other site drawings which show exact boundaries of all cultural resources within the project area and their relationship to project features.

A-6.4. The Contractor shall submit to the Contracting Officer completed National Register forms including photographs, maps, and drawings in accordance with the National Register Program, if any sites inventoried during the survey are found to meet the criteria of eligibility for nomination and for determination of significance. The completed National Register forms shall be submitted with the final report.

A-6.5. At any time during the period of service of this contract, upon the written request of the Contracting Officer, the Contractor shall submit, within 15 calendar days, any portion or all field records described in paragraph C-1.4 without additional cost to the Government.

A-6.6. The Contractor shall supply the appropriate State Historic Preservation Office with completed site forms, survey report summary sheets, maps or other forms as appropriate. Blank forms may be obtained from the State Historic Preservation Office. Copies of such completed forms and maps shall be submitted to the Contracting Officer within 30 calendar days of the end of fieldwork.

A-6-7. The Contractor shall prepare and submit with the final report, a site card for each identified resource or aggregate resource. These site cards do not replace state approved prehistoric, historic, or architectural forms or Contractor designed forms. These 5 X 8 inch cards shall be color-coded. White cards shall be used for prehistoric sites, blue cards for historic sites, green for architectural sites and yellow cards for potentially significant sites. Sites fitting two or more categories will have two or more appropriate cards. This site card shall contain the following information, to the degree permitted by the type of study authorized:

a. Site number

b. Site name

c. Location: section, township, and UTM coordinates (for procedures in determining UTM coordinates, refer to How to Complete National Register Forms, National Register Program, Volume 2.

d. County and state

e. Quad maps

f. Date of record

g. Description of site

h. Condition of site

i. Test excavation results

j. Typical artifacts

k. Chronological position (if known)

l. Relation to project

m. Previous studies and present contract number

n. Additional remarks

A-6.8. Documentation. The Contractor shall submit detailed monthly progress reports to the Contracting Officer by the 7th day of every month for the duration of the contract. These reports will contain an accurate account of all field work, laboratory procedures and results in sufficient detail to allow monitoring of project progress.

A-7. SCHEDULE.

A-7.1. The Contractor shall, unless delayed due to causes beyond his control and without his fault or negligence, complete all work and services under this contract within the following time limitations.

Activity	Completion Time (In calendar days beginning with acknowledged date of receipt of notice to proceed)
Survey/Initial Testing Fieldwork	30
Submittal Management Summary	40
Submittal of Draft Report of Investigations	85
Submittal of Final Report of Investigations	150

A-7.2. The Contractor shall make any required corrections after review by the Contracting Officer. The Contracting Officer may defer Government review comments pending receipt of review comments from the State Historic Preservation Officer or other reviewing agencies. More than one series of draft report corrections may be required. In the event that the government review period is exceeded and upon request of the Contractor, the contract period will be extended automatically on a calendar day for day basis. Such extension shall be granted at no additional cost to the Government.